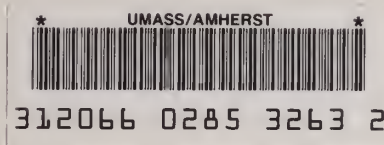


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Annual Analysis of the Impact of Federal R&D Budgets on the Massachusetts Economy

Including Fiscal Year 1998



January 1998

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Annual Analysis of the Impact of Federal R&D Budgets on the Massachusetts Economy

Including Fiscal Year 1998

January, 1998

The Annual Analysis of the Impact of Federal Research and Development Budgets on the Massachusetts Economy was prepared and written by Robert Kispert, Manager of MTC's FedTech Program.

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Background

Planning for Change, Preparing for Growth, an analysis prepared for the Massachusetts Technology Collaborative (MTC) by the Economics Resource Group, Inc. (ERG) in spring, 1996, documented for the first time the key role that federal research and development funding plays in the Massachusetts economy. Massachusetts has the most R&D intensive economy in the country and is more highly reliant on federal funding to support this activity than the other Leading Technology States (LTS).^{*} Because of its importance to the Commonwealth and the uncertainty raised by the on-going debate over how best to balance the federal budget, MTC continues to monitor federal R&D funding trends.

Congress has recently approved FY 1998 appropriations for each of the federal agencies that support the conduct of R&D by our many research universities and industrial concerns. This analysis addresses three major issues:

- trends in federal R&D funding,
- the expected impacts of FY 1998 federal R&D appropriations on the Massachusetts economy,
- perceived trends in Massachusetts' share of federal R&D funding.

FY 98 Federal Research & Development Budget

The President's initial budget submission in February, 1997, projected a constrained budget climate for federal R&D, reflecting the limitations placed by the balanced budget agreement. Of particular concern to Massachusetts was a projected 4.7% cut in the Department of Defense (DoD) Science & Technology budget (6.1-6.3) and a modest 2.7% proposed increase at the National Institutes of Health (NIH), far below the double digit rate normally approved. The proposed R&D budget of \$75.028 billion actually represented a 0.8% cut in constant dollars. Throughout the Congressional appropriation debates, however, a strong economy and low inflation reduced pressure on "discretionary" spending. The resulting appropriations for FY 1998 provide real growth for most federal agencies, particularly those that are important funding resources for Massachusetts.

For FY 1998, overall R&D budget authority will grow 4.2% over FY 1997 levels. All major departments and agencies other than Agriculture and Transportation will see funding increases in excess of the level of inflation. As shown in Figure 1, FY 1998 represents a continuation of last year's return to significant year-to-year funding growth, typical of the 1980's. Highlights include:

- Congress continues to show strong support for investments in R&D, providing \$1.5 billion in increases over the President's Budget Request.
- There is a continued shift in funding priorities from defense to non-defense R&D.
- Funding for basic research has increased overall, and at each agency other than DoD and NASA.
- DoD cuts (\$1 billion) in basic research reflect internal funding priorities and may foreshadow additional reductions resulting from re-engineering the DoD laboratory structure.
- NIH and the National Science Foundation have consistently had expanded budgets (constant-dollar) over the past four years, reflecting broad support for academic research.

^{*} MTC's Index of the Massachusetts Innovation Economy has identified Leading Technology States, against which the state competes. These states are California, Florida, Illinois, New Jersey, New York and Texas.

- Congress appears to have reached an accommodation with several agencies/programs which suffered heavy criticism and funding cuts in the past (e.g., Environmental Protection Agency (EPA), Department of Energy (DoE), Department of Commerce (DoC), Advanced Technology Program). Both EPA and DoC received ~15% increases for FY 1998.
- The new Presidential line-item veto was used to selectively eliminate \$150 million in R&D funding.

The most current information summarizing the FY 1998 budget is contained in Appendix A (AAAS R&D Funding Update, December 6, 1997).

Analysis and Future Outlook

As the initial analyses of the FY 1998 federal R&D budget are made, there is increased optimism that the projections of draconian cuts in federal support are largely behind the R&D community, at least in the area of basic civilian research. The strong performance of the national economy has reduced pressure on discretionary spending - at least for the present. It also appears that the rationale proposed by many - including MTC - of the positive linkage between federal R&D investments and long term economic growth has been recognized as sound. Several proposals to double the level of federal investment in basic research - particularly at NIH - which seemed impossible to contemplate a year ago, now are receiving increased attention.

The outlook for defense R&D, however, is much less optimistic. At a presentation hosted by Congressman Martin Meehan at Hanscom AFB, November 10, 1997, Curt Weldon, Chairman of the House Subcommittee on Defense Research and Development, indicated that the combined pressures of the highest levels of deployment in 50 years, pent-up demand to procure systems and platforms that have been in development for many years, and an overall fixed national defense allotment, will continue to bring strong pressure on basic and applied defense R&D budgets. These pressures are likely to manifest themselves in the abandonment of some areas of R&D activity which have traditionally received DoD support, further consolidation of the DoD laboratory structure through the budgetary process, and, in all likelihood, at least one more round of base closures targeted toward the defense laboratory structure.

The President's FY 1999 Budget Submission in February, 1998 will set the tone for the future debate on the priority to be placed on investments in federally sponsored research and development. According to a press release issued recently by Congressman Joseph Kennedy and Paul Guzzi, president of the Greater Boston Chamber of Commerce, the federal budget agreement still calls for research funding to be cut by 15% between 1999 and 2002. The President's submission should reflect one of the first assessments of the impact of a stronger than expected economy on the budgetary process.

Projected Impact of Federal Funding on Massachusetts

Planning for Growth, Preparing for Change indicated that:

- Massachusetts is the most research intensive state (defined as total R&D expenditures/gross state product) of the LTS, and
- Massachusetts receives a significantly larger share of its R&D investment through federal support than the national average.

These two facts explain the sensitivity of the Massachusetts economy to changes in Federal R&D funding patterns.

Figure 2 presents actual and projected federal R&D funding received by Massachusetts organizations for FY 1986-98. Data through FY 1995 represent actual funding levels, as reported by the National Science Foundation/SRS. Data for FY 1996-8 are MTC estimates based on changes in agency level funding at the national level, applied to the FY 1995 Massachusetts actual data. These data and subsequent estimates show sharp drops in funding in FY 1987 and FY 1994, followed by steady recovery. Based on the estimating methodology employed by MTC, the outlook for federal funding in Massachusetts for FY 1998 appears positive, growing at a rate faster than the rate of inflation and faster than the federal R&D budget as a whole.

Analysis of trends

The share of federal funding obtained by Massachusetts organizations is not growing as expected.

An analysis of Massachusetts funding data indicates that the share of federal funding obtained by Massachusetts organizations is not growing as expected, after taking into account shifts in funding patterns on an agency-by-agency basis. Table 1 presents a comparison of actual federal obligations received by Massachusetts organizations with projections obtained using MTC's estimating methodology. The data for FY 1994 and FY 1995 indicate that Massachusetts did not obtain its projected share of federal R&D funding during this period, based on the relative mix of agency funding authorizations. The data for FY 1994 are particularly disturbing, suggesting that Massachusetts received almost 10% less funding at the state level than would have been expected due to changes in funding at the national level.

An examination of federal obligations by agency and performer (Appendix B) shows that Massachusetts suffered substantial reductions in intramural research at its defense and transportation laboratories (\$45 million), as well as federally funded research and development centers (FFRDC's) administered by universities and non-profit organizations located within the state (\$160 million). The biggest reduction, however, was in defense development contracts - a \$300 million hit. The FY 1995 data suggest that funding for defense development contracts and for FFRDC's has stabilized, but that support for defense laboratories in Massachusetts has continued to decrease substantially (\$40 million). Indications to date are that this trend is continuing, making these installations all the more vulnerable in future rounds of base closures. The FY 1995 data also show that Massachusetts universities received substantially less research funding than would have been expected, given the national funding levels. The data in Appendix B suggest that Massachusetts universities have not benefited as much as would be projected from the increased funding at NSF and NIH.

Despite the positive projection, Massachusetts is facing stronger competition from other states.

This conclusion is corroborated by a AAAS analysis of the region and by NSF's annual ranking of the geographic distribution of R&D funding. This latter analysis (Table 2) shows that Massachusetts has dropped from 4th in FY 1992 to 6th in FY 1995, the latest year for which this ranking is available, although it did maintain its overall share (approximately 5%) of the federal funding distribution. During this period, Texas and Georgia each enjoyed increases of more than \$1 billion to overtake Virginia and Massachusetts in national rank.

The issues of changing market share (%) and market position (rank) are significant because they may foreshadow changes in the relative economic position of Massachusetts with respect to the rest of the nation. The data in Table 2 suggest that the top ten states continue to receive approximately 2/3 of the federal R&D budget. However, the distribution and rank order of states within the top ten has been very dynamic during the period examined. It appears that the drop in rank of Massachusetts has been more the result of shifts in funding from California to Georgia and Texas than a loss of funding to Massachusetts at this point. In the case of Georgia, most of the shift appears to have been the result of defense contract awards; in Texas, the shift appears to have been largely through NASA. Budgetary pressures in both these agencies have lead to substantial consolidation within the defense and aerospace industries and arguably a *winner take all* procurement environment. These major shifts in funding to Georgia and Texas not only create strong new competitors for

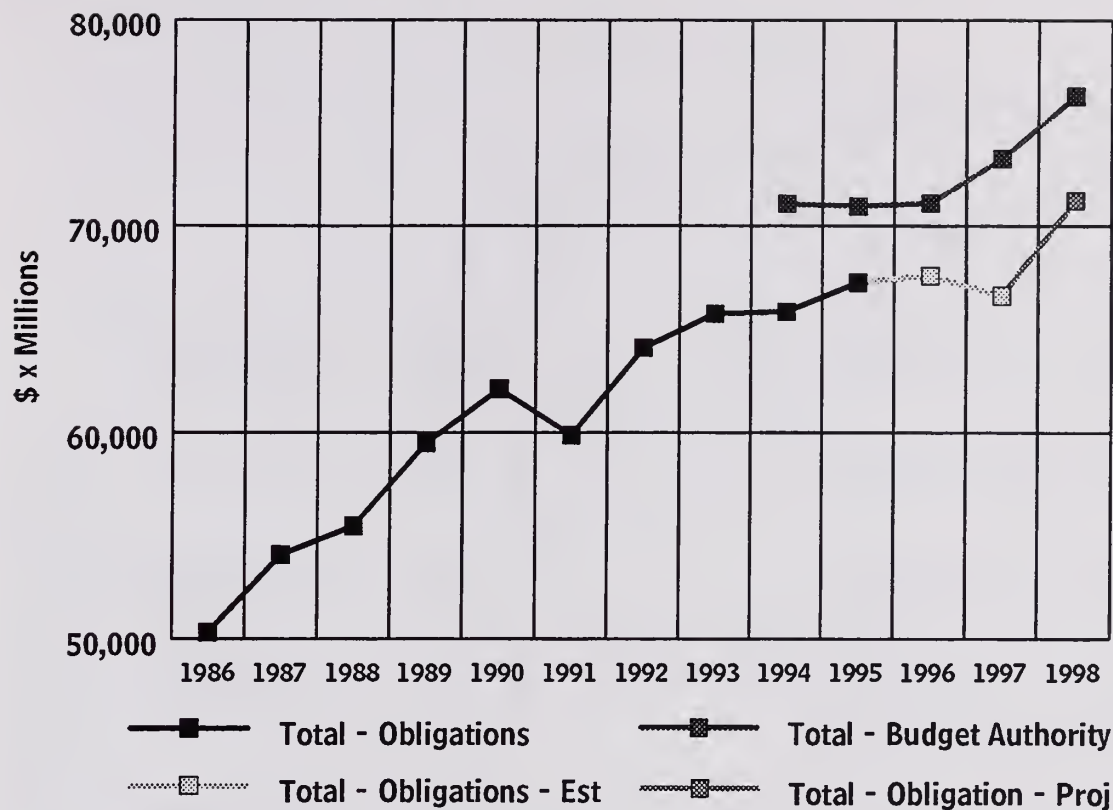
Massachusetts' R&D performers. They also portend competitive advantage for future production contracts from these agencies. Defense research and development still represents almost 55% of Massachusetts' federal funding, and the Commonwealth has a substantial stake in the competitive position of its defense contractors, universities, and laboratories.

Outlook and Conclusions

The analysis conducted for *Planning for Growth, Preparing for Change* projected that proposed cutbacks in federal research and development funding would have a substantial negative impact on the Massachusetts economy. At this point, those cutbacks are still in the future and may, perhaps, never happen. What we can see more clearly, however, is that the threat of these cutbacks remains as a significant issue to be monitored and addressed, as necessary. Equally important, this analysis calls attention to the fact that the federal marketplace is an extremely dynamic and competitive arena, and the Commonwealth faces aggressive new competition.

- As in last year's update, this year's analysis continues to point out the need for continued monitoring of federal R&D funding trends. We can identify substantial threats to segments of the Massachusetts R&D community: defense laboratories (Hanscom and Natick), defense FFRDC's (Lincoln Labs and MITRE), defense R&D contracts, and grants to universities and teaching hospitals from DoD, NIH and NSF. These indicators represent distinct areas of sensitivity which require more real-time monitoring than has previously been available. The Commonwealth needs more timely data for each of these in order to prioritize and take appropriate action against these threats.
- Massachusetts needs to develop a congressional legislative agenda that continues to promote federal R&D support. This analysis has highlighted two issues: 1) the continued decline in support for defense R&D, particularly as it relates to Massachusetts' defense laboratories and FFRDC's, and 2) the level of investment provided for civilian research, particularly through NSF and NIH. In addition, threats to the substantial cluster of Massachusetts firms which receive support through the SBIR/STTR programs need to be addressed as reauthorization approaches.
- Massachusetts needs to develop an aggressive strategy to maintain and improve the competitive position of its R&D community.

Federal R&D Trends, Figure 1



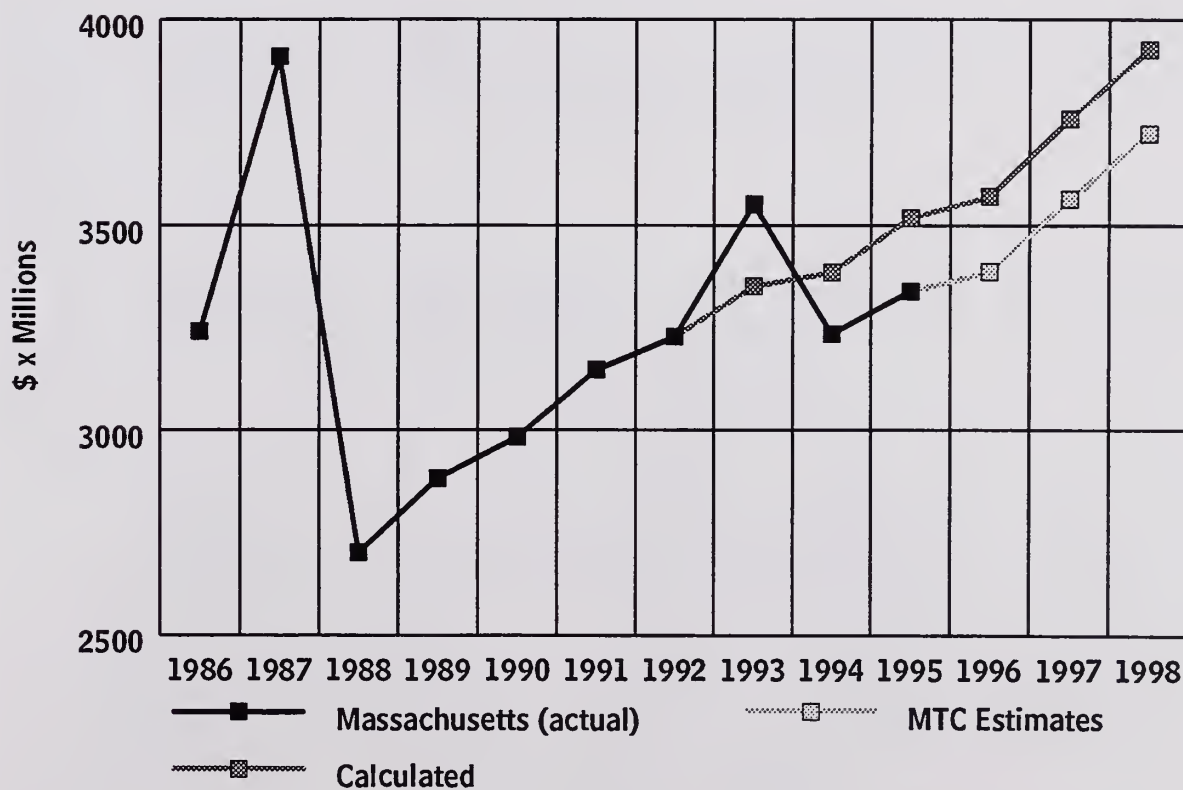
Sources:

Budget Authority -
AAAS estimates for
Total R&D & R&D Plant

Obligations for 1996-97
based on NSF/SRS
estimates for Total R&D

Obligations for 1998
estimated by MTC
based on average ratio
to 1994-97 Budget Authority

Federal R&D Funding in Massachusetts, Figure 2



Source:
NSF/SRS; AAAS;
MTC Estimates

Federal obligations for research and development by State, agency, and performer: fiscal years 1994-8 [Dollars in thousands], Table I

State and agency	1992 Actuals	1993 Actuals	1993 Calc	1994		1995		1996		MTC Estimates	
				Actuals	Calc	Actuals	Calc			1997	1998
Massachusetts, total	3,227,932	3,551,660	3,352,356	3,234,051	3,584,826	3,339,532	3,368,216	3,387,287	3,564,009	3,721,712	
Department of Agriculture	19,781	20,834	19,798	21,664	22,036	21,574	21,520	21,596	22,373	22,507	
Department of Commerce	38,509	37,827	38,813	38,499	47,616	57,772	63,017	48,124	51,830	59,760	
Department of Defense, research 2/	1,938,722	2,168,523	1,922,067	393,866	2,101,006	298,479	403,636	302,658	317,488	326,378	
Department of Defense, total											
development 3/ 4/				1,425,655		1,518,763	1,461,018	1,540,026	1,615,487	1,660,721	
Department of Energy	76,272	82,543	77,369	88,862	79,771	99,989	94,307	94,390	97,693	100,722	
Department of Health & Human Svcs	784,057	853,135	903,577	901,577	913,118	933,229	936,735	978,957	1,053,358	1,124,986	
Department of the Interior	6,959	7,391	7,078	6,471	8,300	6,397	6,406	5,962	5,491	5,826	
Department of Transportation	53,533	80,144	65,501	41,788	91,487	63,704	51,927	57,525	59,883	58,566	
Environmental Protection Agency	32,017	24,701	32,768	19,823	27,606	25,613	20,901	24,435	27,440	31,337	
National Aeronautics and Space Admin	125,134	132,368	131,207	126,941	137,353	146,346	131,152	145,614	143,284	150,879	
National Science Foundation	152,948	144,194	154,177	168,905	156,532	167,668	177,597	168,001	169,681	180,032	
Annual Growth - Massachusetts		10.03%	3.85%	-8.94%	0.93%	3.26%	4.15%	1.43%	5.22%	4.42%	
Sources											
Actuals: National Science Foundation/SRS, Survey											
of Federal Funds for Research and Development:											
Fiscal Years 1994, 1995, 1996											
Fiscal Years 1995, 1996, 1997											
MTC Estimates - 1996-8											
Federal, total	1992 Actuals 64,089,709	1993 Actuals 65,744,145	103%	1994 Actuals 66,066,200	100%	1995 Actuals 68,794,700	104%	1996 67,573,900	1997 MTC Estimates	1998	
Department of Agriculture	1,322,107	1,323,247	100%	1,399,600	106%	1,390,300	99%	1,393,100			
Department of Commerce	651,133	656,268	101%	826,100	126%	1,352,200	164%	1,325,800			
Department of Defense, research 2/	35,986,039	35,676,894	99%	34,566,100	97%	35,423,500	102%	33,706,000			
Department of Defense, total											
development 3/ 4/											
Department of Energy	6,169,425	6,258,196	101%	6,048,000	97%	6,418,600	106%	6,842,300			
Department of Health & Human Svcs	8,935,398	10,297,491	115%	11,021,500	107%	11,451,300	104%	11,828,200			
Department of the Interior	607,691	618,056	102%	694,100	112%	687,100	99%	683,200			
Department of Transportation	444,389	543,742	122%	620,700	114%	771,300	124%	710,100			
Environmental Protection Agency	483,900	495,253	102%	553,500	112%	583,600	105%	676,400			
National Aeronautics and Space Admin	7,625,035	7,995,102	105%	8,296,200	104%	8,571,400	103%	8,105,700			
National Science Foundation	1,864,592	1,879,576	101%	2,040,400	109%	2,145,400	105%	2,303,100			
Annual Growth - Federal		2.6%		0.5%		4.1%		-1.8%			

Federal obligations for research and development,

1992		1993		1994		1995	
State	Total \$	State	Total \$	State	Total \$	State	Total \$
Total.	64,089,709	100.0%	Total.	100.0%	Total	100.0%	Total
California	15,999,143	25.0%	California	22.6%	California	17.1%	California
Maryland	5,779,695	9.0%	Maryland	11.0%	Maryland	10.1%	Maryland
Virginia	3,231,339	5.0%	Massachusetts	5.4%	Georgia	8.4%	Georgia
Massachusetts	3,227,932	5.0%	Virginia	5.2%	Virginia	5.7%	Texas
New York	3,058,737	4.8%	Georgia	3.0%	Texas	5.6%	Virginia
Texas	2,872,956	4.5%	Florida	4.2%	Massachusetts	4.9%	Massachusetts
Florida	2,832,290	4.4%	Pennsylvania	3.9%	Florida	4.4%	District of Columbia
Georgia	2,512,567	3.9%	Texas	3.9%	New York	4.1%	New York
New Mexico	2,211,251	3.5%	New York	3.5%	District of Columbia	3.8%	Pennsylvania
District of Columbia	2,185,196	3.4%	District of Columbia	3.8%	Missouri	3.5%	Florida
Total - Top States	43,911,106	68.5%	Total - Top States	68.5%	Total - Top States	67.5%	Total - Top States
			45,026,835		44,450,793		45,317,880
							67.4%

Appendix A

AAAS R&D Funding Update - December 5, 1997

A Preview Report for Congressional Action on Research and Development in the FY 1998 Budget

**A Preview Report for
*Congressional Action on Research and Development
in the FY 1998 Budget***

This AAAS R&D Funding Update is a preview of the forthcoming publication *Congressional Action on Research and Development in the FY 1998 Budget*. (Ordering information is on the last page). This report reflects **final FY 1998 appropriations** for research and development.

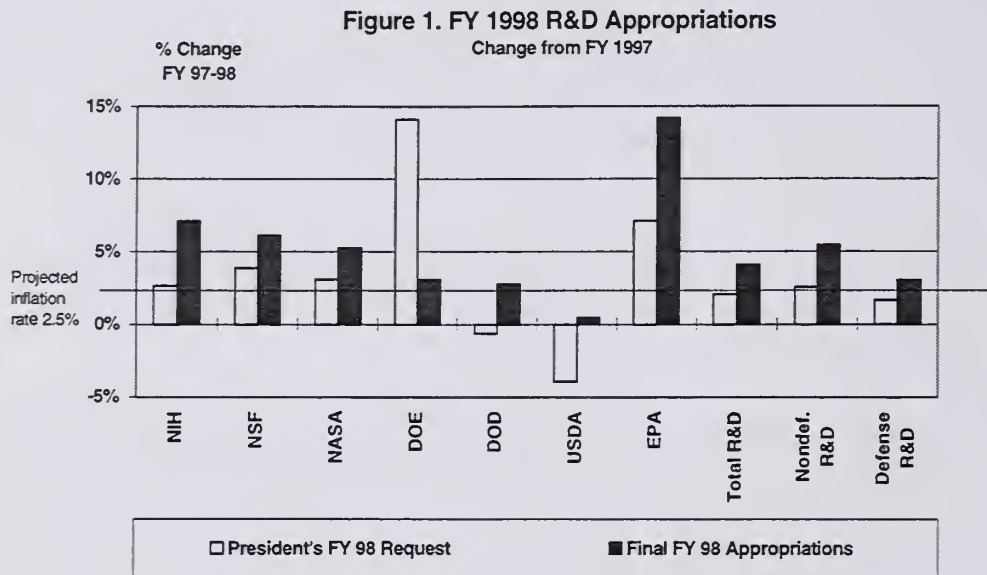
With his last line-item veto on December 2, President Clinton put the final touches on FY 1998 appropriations for the federal investment in research and development (R&D). Although Congress had long since left Washington after adjourning on November 13, the President waited until November 26 to sign the last few appropriations bills into law, and FY 1998 appropriations did not become final until five days later on December 2, the deadline for his use of the line-item veto.

Every year, AAAS analyzes appropriations as signed into law and provides detailed estimates on the federal investment in R&D for the coming fiscal year in the publication *Congressional Action on Research and Development*. The FY 1998 edition will be released in late December. This preview report offers selected highlights from the book.

Highlights

In the FY 1998 budget process, higher-than-expected revenues from continued economic growth resulted in a windfall for discretionary programs. This, combined with renewed support for R&D as a high national priority, allowed federal support for R&D in FY 1998 to receive substantial increases across the board (see Table 1).

- Total federal support for R&D in FY 1998 is \$76.3 billion, \$3.0 billion or 4.1 percent more than FY 1997. Every major R&D funding agency except Transportation and Agriculture received increases well ahead of the expected 2.5 percent inflation rate (see Figure 1).
- The FY 1998 total is \$1.5 billion or 2.0 percent above the President's request. Although the President's request contained nearly \$1 billion for the full construction costs of various R&D facilities, Congress chose to fund only the FY 1998 installments of these costs. Most other agencies received more than requested (see Figure 1).



AAAS - Based on AAAS estimates of R&D in FY 1998 appropriations.

DOE FY 98 Request includes nearly \$1 billion in up-front facilities funding

- Total defense R&D for FY 1998 is \$41.0 billion, an increase of 3.1 percent, for defense programs in the Department of Defense (DOD) and DOE. The budget request was for a smaller, 0.5 percent increase. After adjusting for inflation, defense R&D has declined 2.7 percent between FY 1994 and FY 1998; however, it still represents 53.8 percent of total R&D.
- The nondefense R&D total of \$35.3 billion for FY 1998 is \$1.8 billion or 5.4 percent more than FY 1997, significantly ahead of the 2.5 percent expected inflation rate in FY 1998. Because of cuts in the previous three years, however, nondefense R&D in FY 1998 is 2.2 percent below FY 1994 in inflation-adjusted terms.
- The Department of Defense (DOD) has an R&D budget of \$38.1 billion in FY 1998, a \$1.0 billion or 2.8 percent increase over last year. This amount is \$1.3 billion more than the President requested, primarily because of a \$704 million supplement to the request for the Ballistic Missile Defense Organization (total \$3.3 billion). Basic research (the "6.1" account) falls 1.2 percent to \$1.1 billion, but applied research, including DOD's expanding effort in medical research, climbs 7.0 percent to \$3.1 billion.
- The National Institutes of Health (NIH) fared especially well because of strong bipartisan support for its efforts in biomedical research. NIH's R&D budget for FY 1998 is \$13.1 billion, a \$871 million or 7.1 percent increase from FY 1997. Most institutes received increases in the 6 to 8 percent range, except for the National Human Genome Research Institute (\$218 million, up 15.2 percent) and

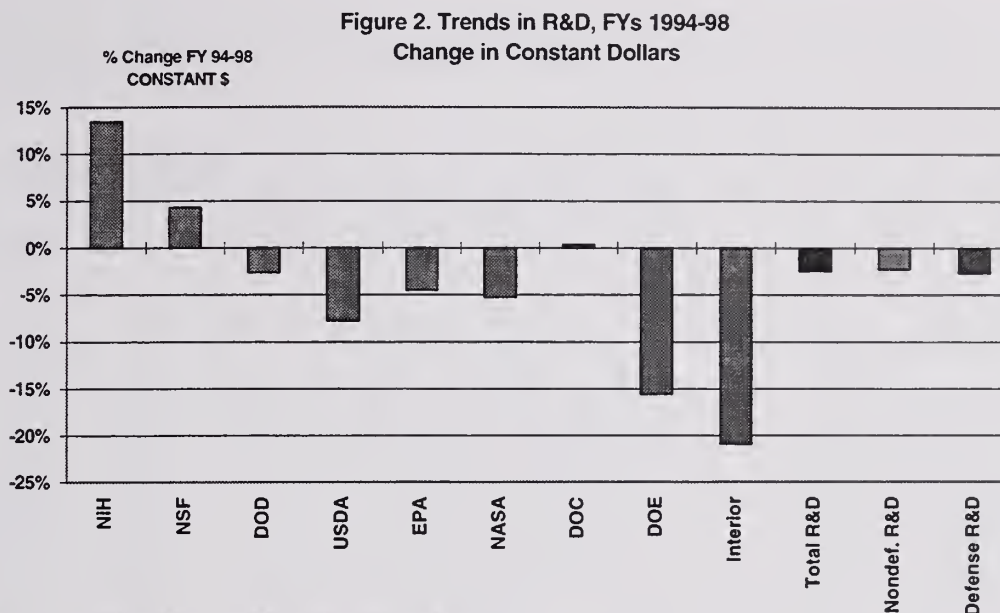
the Office of the Director (\$296 million, up 3.6 percent). Although AIDS research did not receive a separate appropriation, total AIDS research is expected to exceed \$1.6 billion.

- The National Aeronautics and Space Administration (NASA) has an R&D budget of \$9.8 billion (up \$493 million or 5.3 percent) within a total budget of \$13.6 billion. \$203 million of the increase will cover cost overruns on the development phase of the Space Station, for a total of \$2.4 billion. Aeronautics and Space Technology gains 11.3 percent to \$1.5 billion in FY 1998 for development of new launch vehicles.
- The Department of Energy (DOE) has an R&D budget of \$6.3 billion for FY 1998, \$189 million or 3.1 percent more than FY 1997. Much of the increase is due to a 6.4 percent jump in DOE's defense R&D to \$3.0 billion, including a 12.7 percent increase to \$1.9 billion for Stockpile Stewardship. General Science R&D moves up \$15 million or 1.5 percent to \$1.0 billion. Energy R&D declines 0.1 percent to \$2.3 billion. Increases for R&D in programs such as Solar and Renewable Energy (\$276 million, up 15.6 percent) and Energy Conservation (\$356 million, up 10.0 percent) are offset by rescissions in the Clean Coal Technology program.
- The National Science Foundation (NSF) received \$2.6 billion for its R&D in FY 1998. This is \$54 million more than the request and \$149 million or 6.1 percent more than FY 1997. Major Research Equipment received \$109 million, mostly to begin renovation of U.S. research facilities in Antarctica. The core Research and Related Activities account totals \$2.5 billion, an increase of 4.7 percent.
- The Department of Commerce's R&D programs received the largest percentage increase among the agencies: 14.8 percent or \$146 million in FY 1998, for a total of \$1.1 billion. The National Institute of Standards and Technology (NIST) received \$95 million to renovate its aging laboratory facilities, in sharp contrast to a \$16 million rescission last year. The Advanced Technology Program's R&D budget falls to \$182 million from \$203 million. R&D in the NIST labs increases by a modest 1.1 percent or \$2 million to \$227 million. NOAA's natural resources and environment R&D totals \$613 million, a 9.0 percent increase because of increasing concern over ElNiño and *pfisteria*.
- The U.S. Department of Agriculture (USDA) received \$1.6 billion for R&D in FY 1998, a slight increase of 0.5 percent. There are sharp cuts in congressionally designated R&D facilities projects, allowing for increases for most research programs.
- The Department of the Interior's (DOI) R&D budget grows by 6.1 percent in FY 1998 to \$616 million. The U.S. Geological Survey received \$538 million for its R&D, \$9 million or 1.7 percent more than FY 1997 because of increases for its

biological research activities. The National Park Service's new initiative on ecosystems research in the Florida Everglades received \$20 million.

- The Environmental Protection Agency (EPA) emerged as a big winner among research agencies this year. EPA's R&D in FY 1998 totals \$618 million, \$77 million or 14.2 percent more than FY 1997. Congress is increasingly concerned that EPA's regulatory activities, especially in particulate matter, be based on sound science.
- Federal support for basic research, most of which is performed at the nation's colleges and universities, is estimated to total \$15.5 billion in FY 1998, 4.6 percent or \$679 million more than FY 1997 and \$235 million more than the request. As a result, increases in federal support for academic R&D should stay ahead of inflation in FY 1998. In the past three years, increases to basic research have kept pace with inflation. The FY 1998 funding level is 3.1 percent above the FY 1994 level after adjusting for inflation.
- The "Federal Science and Technology" (FS&T) budget, an alternative measure for the federal investment in science and technology proposed by the National Academy of Sciences, increases by 5.5 percent in FY 1998 to reach \$41.5 billion. The growth rate in FS&T is nearly the same as in nondefense R&D (5.4 percent), but higher than that of total R&D because defense advanced development, testing and evaluation programs (DOD accounts "6.4" through "6.7" and some DOE work), excluded from the FS&T budget, increase only modestly in FY 1998.
- Most functional categories of R&D see significant gains in R&D, reflecting the importance of R&D to various national missions (see Table 2). Health-related R&D leads the way with \$14.1 billion, up 6.6 percent, because of increases for NIH. Commerce-related R&D sees the biggest percentage gain (up 22.6 percent) because of funds for laboratory construction. Natural resources and environment R&D jumps 8.2 percent to \$2.1 billion because of substantial increases for Interior, EPA, and the National Oceanic and Atmospheric Administration (NOAA).
- Although most agencies received substantial increases in FY 1998, the longer-term trend is still negative. As Figure 2 shows, between FY 1994 and 1998 only NIH, NSF, and Commerce managed to keep their R&D budgets ahead of the rate of inflation. Other agencies suffered large budget cuts in FY 1995 and 1996 and have not recovered lost ground, even after increases in FY 1997 and 1998.

The full report offers 15 detailed funding tables, several charts, a chronology of the events in the FY 1998 budget process, an analysis of funding trends, and analyses of the impacts of the FY 1998 budget on each of the major R&D funding agencies.



Source: AAAS Report XX and AAAS estimates for R&D in FY 1998 appropriations. Adjusted for inflation according to OMB's GDP deflators.

Publication Information

The AAAS publication *Congressional Action on Research and Development in the FY 1998 Budget*, from which this is excerpted, will be available in late December from AAAS. Ordering information is as follows:

Congressional Action on Research and Development in the FY 1998 Budget, Kei Koizumi, Albert H. Teich, Stephen D. Nelson, Joanne Padrón Carney, 1997. AAAS Publication Number 97-20S. \$10.95; \$8.75 to AAAS members.

The report may be ordered from the AAAS Distribution Center. Please add \$4.00 for postage and handling per order. Orders must be prepaid by check or accompanied by purchase order payable to AAAS. Address: AAAS Distribution Center, P.O. Box 521, Annapolis Junction, MD 20701. For VISA / Mastercard orders call 1-800-222-7809 (8:30 AM - 5:00 PM ET). Fax orders to 301-206-9789. For shipments to CA and DC, add applicable sales tax. For shipments to Canada, add the GST. Please allow 2-3 weeks for delivery. Inquiries may be directed to AAAS (see below).

- December 5, 1997

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Table 1. Total R&D by Agency (FINAL)
Congressional Action on R&D in the FY 1998 Budget
(budget authority in millions of dollars)*

	FY 1997 Est. **	FY 1998 Request	FY 1998 FINAL	Action by Congress			
				Chg. from Request		Chg. from FY 1997	
				Amount	Percent	Amount	Percent
Defense (military)	37,026	36,780	38,066	1,285	3.5%	1,040	2.8%
National Aeronautics and Space Admin.	9,315	9,604	9,808	204	2.1%	493	5.3%
Energy	6,103	6,964	6,292	-673	-9.7%	189	3.1%
Health and Human Services	12,935	13,226	13,809	583	4.4%	874	6.8%
<i>National Institutes of Health</i>	<i>12,206</i>	<i>12,531</i>	<i>13,077</i>	<i>546</i>	<i>4.4%</i>	<i>871</i>	<i>7.1%</i>
National Science Foundation	2,424	2,519	2,573	54	2.1%	149	6.1%
Agriculture	1,544	1,483	1,551	68	4.6%	7	0.5%
Interior	581	608	616	8	1.3%	35	6.1%
Transportation	650	684	636	-48	-7.0%	-14	-2.2%
Environmental Protection Agency	541	579	618	38	6.6%	77	14.2%
Commerce	983	1,088	1,128	41	3.8%	146	14.8%
Education	185	210	210	0	-0.1%	25	13.4%
Agency for International Development	169	225	173	-52	-23.1%	4	2.4%
Department of Veterans Affairs	271	243	281	38	15.8%	10	3.8%
All Other	525	551	527	-24	-4.4%	2	0.3%
Total R&D	73,251	74,766	76,288	1,522	2.0%	3,037	4.1%
Defense R&D	39,801	40,457	41,018	561	1.4%	1,217	3.1%
Nondefense R&D	33,450	34,309	35,270	961	2.8%	1,820	5.4%
Basic Research	14,853	15,296	15,531	235	1.5%	679	4.6%
*FS&T****	39,318	41,158	41,497	338	0.8%	2,179	5.5%

* - Authors' estimates. Includes conduct of R&D and R&D facilities.

** - FY 1997 figures adjusted to reflect rescissions and supplementals enacted in Public Law 105-18.

*** - A new measure of the federal investment in science and technology proposed by the National Academy of Sciences.
This figure includes all federal R&D except advanced development, testing and evaluation work in DOD and DOE.

**Table 2. Major Functional Categories of R&D (FINAL)
Congressional Action on R&D in the FY 1998 Budget
(budget authority in millions)***

	FY 1997 Est. **	FY 1998 Request	FY 1998 Approved	Action by Congress			
				Chg. from Request Amount	Percent	Chg. from FY 1997 Amount	Percent
Defense ¹	39,801	40,457	41,018	561	1.4%	1,217	3.1%
Nondefense ²	33,450	34,309	35,270	961	2.8%	1,820	5.4%
Space	8,032	8,235	8,419	184	2.2%	388	4.8%
Health	13,184	13,434	14,051	617	4.6%	867	6.6%
Energy	2,443	2,410	2,462	52	2.2%	19	0.8%
General Science	3,410	3,522	3,574	52	1.5%	164	4.8%
Natural Resources & Environment	1,912	1,986	2,069	84	4.2%	157	8.2%
Agriculture	1,361	1,300	1,360	60	4.6%	-1	-0.1%
Transportation	1,933	2,053	2,025	-28	-1.4%	92	4.7%
Commerce	419	515	514	0	-0.1%	95	22.6%
International	191	247	195	-52	-21.0%	4	2.1%
All Other	564	607	599	-8	-1.3%	35	6.3%
Total R&D	73,251	74,766	76,288	1,522	2.0%	3,037	4.1%

* Authors' estimates. Includes conduct of R&D and R&D facilities.

** - FY 1997 figures adjusted to reflect rescissions and supplementals enacted in Public Law 105-18.

Classifications generally follow the government's budget function categories except health (which here includes health R&D in HHS and VA).

¹ Includes DOD R&D and atomic energy defense R&D in DOE.

² Includes all R&D not in defense (domestic and international discretionary programs).

Appendix B
Federal obligations for research and development by State, agency, and performer:
fiscal year 1992-5 (Dollars in thousands)

State and agency	Total	Intra-mural 1/	Extramural						State and local govts
			Industrial firms	FFRDCs admin by industrial firms	Universities and colleges	FFRDCs admin by univs and colleges	Other nonprofit institutions	FFRDCs admin by nonprofit institutions	

Table C-136. Federal obligations for research and development, by State, agency, and performer: fiscal year 1992 [Dollars in thousands]

Massachusetts, total	3,227,932	362,532	1,320,154	4,715	738,960	187,025	482,379	126,850	5,317
Department of Agriculture	19,781	14,102	125	0	5,229	0	325	0	0
Department of Commerce	38,509	27,026	4,821	0	6,390	0	187	0	85
Department of Defense, research 2/	336,441	87,646	111,446	0	114,509	19,962	2,508	370	0
Dept of Defense, development 2/	1,602,281	152,840	1,089,136	4,715	38,214	166,992	24,001	126,383	0
Department of Energy	76,272	0	8,767	0	64,619	0	2,886	0	0
Department of Health & Human Svcs	784,057	27,691	54,223	0	312,520	0	384,912	0	4,711
Department of the Interior	6,959	5,435	0	0	929	0	595	0	0
Department of Transportation	53,533	47,113	3,611	0	2,809	0	0	0	0
Environmental Protection Agency	32,017	0	16,355	0	8,988	0	6,153	0	521
National Aeronautics and Space Admin	125,134	527	25,700	0	47,606	71	51,230	0	0
National Science Foundation	152,948	152	5,970	0	137,147	0	9,582	97	0

Table C-82. Federal obligations for research and development by State, agency, and performer: fiscal year 1993 [Dollars in thousands]

Massachusetts, total	3,551,660	383,885	1,506,230	0	681,394	265,479	525,805	175,494	13,373
Department of Agriculture	20,834	14,729	6	0	5,784	0	315	0	0
Department of Commerce	37,827	27,169	7,260	0	2,497	538	307	0	56
Department of Defense, research 2/	375,077	86,994	123,748	0	117,166	21,961	24,334	731	143
Dept of Defense, development 2/	1,793,446	170,406	1,243,021	0	14,047	175,698	15,701	174,573	0
Department of Energy	82,543	727	6,836	0	71,704	0	3,276	0	0
Department of Health & Human Svcs	853,135	27,457	63,820	0	279,415	53,814	423,085	0	5,544
Department of the Interior	7,391	5,383	331	0	1,296	0	55	0	326
Department of Transportation	80,144	50,019	6,975	0	2,613	13,419	0	0	7,118
Environmental Protection Agency	24,701	0	18,489	0	6,026	0	0	0	186
National Aeronautics and Space Admin	132,368	549	26,365	0	49,424	49	55,981	0	0
National Science Foundation	144,194	452	9,379	0	131,422	0	2,751	190	0

Table C-82. Federal obligations for research and development by State, agency, and performer: fiscal year 1994 [Dollars in thousands]

Massachusetts, total	3,234,051	341,397	1,226,730	0	825,912	137,609	548,924	140,090	13,389
Department of Agriculture	21,664	14,798	167	0	6,351	0	348	0	0
Department of Commerce	38,499	27,636	6,903	0	3,236	157	221	0	346
Department of Defense, research 2/	393,866	86,217	137,258	0	129,038	12,815	27,853	685	0
Department of Defense, total development 3/ 4/	1,425,655	150,025	944,974	0	56,178	124,637	15,966	133,875	0
Department of Energy	88,862	129	6,176	0	79,045	0	3,512	0	0
Department of Health & Human Svcs	901,577	29,448	71,902	0	347,446	0	446,827	0	5,954
Department of the Interior	6,471	5,349	315	0	807	0	0	0	0
Department of Transportation	41,788	25,159	8,636	0	2,453	0	0	0	5,540
Environmental Protection Agency	19,823	0	15,513	0	2,761	0	0	0	1,549
National Aeronautics and Space Admin	126,941	2,090	25,808	0	49,418	0	44,237	5,388	0
National Science Foundation	168,905	546	9,078	0	149,179	0	9,960	142	0

Table C-83. Federal obligations for research and development, by State, agency, and performer: fiscal year 1995 [Dollars in thousands]

Massachusetts, total	3,339,532	315,749	1,337,516	0	767,355	160,583	587,363	158,589	12,377
Department of Agriculture	21,574	15,529	160	0	5,364	0	521	0	0
Department of Commerce	57,772	26,479	27,207	0	3,682	0	49	0	355
Department of Defense, research 2/	298,479	62,721	110,811	0	85,422	20,058	18,687	780	0
Department of Defense, total development 3/ 4/	1,518,763	131,204	1,047,826	0	23,721	129,278	31,588	155,146	0
Department of Energy	99,989	20	7,177	0	86,485	0	6,307	0	0
Department of Health & Human Svcs	933,229	27,841	83,281	0	343,448	2,805	468,178	0	7,676
Department of the Interior	6,397	5,249	81	0	697	0	370	0	0
Department of Transportation	63,704	41,926	7,954	0	1,909	7,729	0	0	4,186
Environmental Protection Agency	25,613	0	15,532	0	8,030	0	1,891	0	160
National Aeronautics and Space Admin	146,346	3,593	28,584	0	58,896	343	52,381	2,549	0
National Science Foundation	167,666	1,187	8,903	0	149,701	0	7,761	114	0

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